

Enrolment No./Seat No _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-III (NEW) EXAMINATION – SUMMER 2024

Subject Code:3132606

Date:16-07-2024

Subject Name:Numerical methods & Viscoelastic models of Elastomers

Time:10:30 AM TO 01:00 PM

Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1** (a) A string has a diameter of 1 cm and the original length of 2 m. The string is pulled by a force of 200 N. Determine the change in length of the string. Young's modulus of the string = 5×10^9 N/m² **03**
- (b) Two liters of water, when subjected to a pressure of 10 atmospheres, are compressed by 1.013 cc. Find the Compressibility of water **04**
- (c) Distinguish between bulk modulus and young modulus. **07**
- Q.2** (a) Mention the properties of typical elastomers. **03**
- (b) Discuss the structure of an ideal elastomers. **04**
- (c) Explain the elasticity of a network and derive its equation. **07**
- OR**
- (c) A mild steel wire of radius 0.5 mm and length 3 m is stretched by a force of 49N. Calculate: (a) longitudinal stress (b) longitudinal strain (c) elongation produced in the body is Y for steel is 2.1×10^{11} N/m². **07**
- Q.3** (a) Explain the term viscoelasticity with suitable example. **03**
- (b) Define the term Viscosity and write its nomenclature. **04**
- (c) Discuss in detail about the Viscosity theory. **07**
- OR**
- Q.3** (a) Give the difference between stress relaxation and stress retardation. **03**
- (b) Write the phenomena of viscous flow with suitable example. **04**
- (c) Discuss in detail about the capillary viscometer. **07**
- Q.4** (a) Derive the hook's model equation for elastic material. **03**
- (b) Explain the maxwell model and give its disadvantages. **04**
- (c) A polystyrene sample of $0.02/m^2$ cross-sectional area is subjected to a creep load of 10^5 N. The load is removed after 30 s. assuming that the Maxwell element accurately describes the behavior of polystyrene and that viscosity is 5×10^{10} P, while Young's modulus is 5×10^5 psi, calculate: (a) The compliance, (b) The deformation recovered on the removal of the dead load & (c) The permanent **07**
- OR**
- Q.4** (a) Define terms: (i) Toughness (ii) Brittleness (iii)Ductility **03**
- (b) Give the importance of Deborah number. **04**
- (c) Derive the equation for creep experiment for Voight model. **07**

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| Q.5 | (a) What is the Tg of butadiene-styrene copolymer containing 10 vol% styrene? | 03 |
| | (b) Give the difference between pseudoplastic fluid and dilatant fluid. | 04 |
| | (c) Discuss in detail about the factors affecting glass transition temperature. | 07 |

OR

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| Q.5 | (a) Toluene behaves as a plasticizer for polystyrene. Estimate Tg of a polystyrene sample containing 20 vol% toluene. | 03 |
| | (b) Distinguish between thixotropic fluid and rheopectic fluid. | 04 |
| | (c) Discuss in detail about states of aggregation. | 07 |
